Name of Organization: Western Michigan University

Type of Organization: College or University

Contact Information: Dr. Daniel Cassidy

Department of Geosciences

1187 Rood Hall, Western Michigan University

Kalamazoo MI 49008

Phone: (616) 387 - 5343 **Extension:**

Fax: (616) 387 - 5513

E-Mail: daniel.cassidy@wmich.edu

Project Title: Evaluation of Technologies for PCB-contaminated Sediments

Project Category: Contaminated Sediments

Rank by Organization (if applicable): 0

Total Funding Requested ($): 92,000 **Project Duration:** 0.5 Years

Abstract:

Since the mid-1950's, discharges from paper mill operations have contaminated an 80 mile stretch of the Kalamazoo River and its outlet into Lake Michigan with polychlorinated biphenyl's (PCB's). The site was placed on the National Priority List (NPL) in August 1990 with the Michigan Department of Environmental Quality (MDEQ) as the lead agency. Cleanup efforts to date have focused primarily on containment of the source of the contamination (i.e. PRP-owned landfills and impoundment's) preventing further spread of the contamination into the river. The focus is now shifting to removal of PCB contaminated sediments from the down stream river and Lake Allegan.

Soil washing is identified as a potentially suitable technology for decontaminating Kalamazoo River Sediments. The technology is based on a combination of physical separation and/or chemical extraction (using specialty surfactants) to remove the PCB's from the sediments. Treated sediments can be used as clean backfill or other beneficial reuse. Full scale soil washing has been successfully applied on many projects (re: Pilot Scale and Full Scale Soil Washing, Journal of Hazardous Materials 66 (1999) p. 119-136). Most recently (1999) soil washing was successfully applied for the decontamination of PCB-contaminated soils at the Springfield Township Superfund Site in Michigan.

This research will evaluate the technical feasibility and economic advantages of using soil washing technologies as a cost-effective, environmentally preferable alternative to the current PRP-directed RI/FS remediation approach.

Geographic Areas Affected by the Project

States:

- [x] Illinois
- [x] Indiana
- [x] Michigan
- [x] Minnesota
- [x] New York
- [x] Pennsylvania
- [x] Wisconsin
- [x] Ohio

Lakes:

- [x] Superior
- [x] Huron
- [x] Michigan
- [x] Erie
- [x] Ontario
- [x] All Lakes

Geographic Initiatives:

- [ ] Greater Chicago
- [ ] NE Ohio
- [ ] NW Indiana
- [ ] SE Michigan
- [ ] Lake St. Clair

Primary Affected Area of Concern: Kalamazoo River, MI

Other Affected Areas of Concern: All PCB-contaminated AOCs

For Habitat Projects Only:

Primary Affected Biodiversity Investment Area:

Other Affected Biodiversity Investment Areas:

Problem Statement:

Since the mid-1950s, discharges from paper mill operations have contaminated an 80 mile stretch of the Kalamazoo River with polychlorinated biphenyls (PCBs). The contamination from the City of Kalamazoo to the river's mouth at Lake Michigan, affects the water column, river sediments, riparian wetlands and floodplains, and is second only in severity to that of the Fox River/Green Bay system in Wisconsin. The United States Environmental Protection Agency determined that approximately 50 kg of PCBs enter Lake Michigan from the Kalamazoo River each year. Since 1977, the State of Michigan has placed a fish consumption advisory/ban in this area due to elevated levels of PCBs in fish. The River was placed on the National Priority List (NPL) in August 1990 and designated the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. The Michigan Department of Environmental Quality (MDEQ) was specified as the lead agency.

Cleanup operations to date have been planned, designed and funded by the Potentially Responsible Parties (PRPs) with oversight from MDEQ and have focused primarily on the landfills and impoundments that are a continued source of contaminants to the river. Remedial action of these source areas (called Operable Units) is nearing completion. The focus of the cleanup will now shift to the removal of the contamination remaining in the river system.

Estimates predict that up to 10 million yd3 of Kalamazoo River system sediments are contaminated with approximately 200,000 pounds of PCBs. Based on studies to date, the current remediation approach being advanced by the RI/FS process involves limited physical stabilization of erodable sediments and natural attenuation. Limitations and disadvantages of this alternative include low public acceptability, high risk of breakthrough contamination, and catastrophic consequences from the inevitable low probability storm events (e.g., a 500-year flood). In addition, agency endorsement of this alternative is far from supportive.

The restoration of Kalamazoo River will be a complex and costly undertaking that will undoubtedly require the application of several technologies to address contamination in a multitude of environmental settings (e.g., fine-grained, highly organic benthic sediments; coarse-grained benthic sediments, various riparian/floodplain soils, etc.). In situations where the removal of PCB contamination is required, soil washing technologies have the potential to substantially reduce the volume of contaminated material, and thereby, reduce the cost of transport and disposal, as well as other impacts. Additionally, soil washing is a water-based technology that is entirely compatible with hydraulic dredging. Hydraulic dredging addresses many of the concerns of environmental dredging including minimal contaminant resuspension, excellent maneuverability, positioning accuracy, mobility, and suitability to a range of hydrodynamic conditions. Dredged sediment slurry can be pumped directly to the soil washing processing plant for treatment, thereby eliminating the need for dry excavation of river bottom sediments and multiple handling activities.

Proposed Work Outcome:

The primary objective of this research is to evaluate soil washing as a technology for cleanup of PCB-contaminated sediments in the Kalamazoo River. The study will determine the technical feasibility and economic advantages of soil washing for treatment of PCB-contaminated sediments.

Three volume reduction technologies and one chemical stabilization technology will be evaluated. Size-separation soil washing provides substantial volume reduction by physically separating and retaining for disposal only those sediment fractions that attract and hold PCB contaminants. Surfactant soil washing provides substantial volume reduction by extracting PCB contaminants from various sediment types leaving them contaminant free. Physical dewatering of sediments can provide significant reduction of disposal volume by removing water. Chemical stabilization/solidification of contaminated sediments can provide a chemically stable, concrete-like end product that is potentially useful as roadbed material, highway median barriers or other uses.

Major Tasks include:

1. Characterization of Sediments - Multiple (Five) samples of contaminated sediments from various areas in and along the Kalamzoo River will be characterized for particle size distribution and distribution of PCB's within the sediment fractions.

2. Physical Separation - Wet screening and hydrocyclone separation will be performed to separate gravel, sand and fines fractions on the five samples of contaminated sediment. A mass balance will be performed and each of the fractions will be analyzed for PCBs.

3. Extraction of PCB's - Specialty surfactants will be used to extract PCBs from contaminated sediment fractions. The efficiencies of the extraction will be determined through analysis of sediments prior to and after extraction.

4. Dewatering of Sediments - Dewatering of sediment fractions will be evaluated using natural consolidation and through use of a mechanical filter press equipment.

5. Chemical Stabilization/solidification - Chemical stabilization/solidification will be performed on contaminated sediment fractions using a commercial proprietary reagent formulation to provide a chemically stable, concrete-like end product suitable for beneficial reuse or disposal. An appropriate chemical leach test will be employed to define the effectiveness of stabilization.

6. Economic Evaluation - Based on the results of the testing, technical and economic evaluations will be performed for various treatment scenarios and technology combinations relative to a full-scale operation.

7. Report Preparation - A full report of the research and findings will be generated documenting the results of the study.

Results of this study will be directly applicable to the remediation of the PCB-contaminated sediments of the Kalamazoo River and may have a direct influence on the current Remedial Investigation/Feasibility Study (RI/FS) decision making process with respect to the remediation of the Kalamazoo River Superfund Site. The results and recommendations of this study could also be applied to other river and harbor sediment remediation projects in the Great Lakes Basin and elsewhere.

Project Milestones:	**Dates:**
Project Start	07/2000
Characterization of Sediments	08/2000
Physical Separation	10/2000
Extraction of PCBs	10/2000
Dewatering of Sediments	10/2000
Chemical Stabilization/Solidification	10/2000
Technical/Economic Evaluations	11/2000
Report Preparation - Project End	12/2000

☐ Project Addresses Environmental Justice

If So, Description of How:

☐ Project Addresses Education/Outreach

If So, Description of How:

Project Budget:

	Federal Share Requested ($)	Applicant's Share ($)
Personnel:	7,000	7,000
Fringe:	0	0
Travel:	0	0
Equipment:	1,000	0
Supplies:	0	0
Contracts:	84,000	0
Construction:	0	0
Other:	0	0
Total Direct Costs:	92,000	7,000
Indirect Costs:	0	0
Total:	92,000	7,000
Projected Income:	0	0

Funding by Other Organizations (Names, Amounts, Description of Commitments):

NA

Description of Collaboration/Community Based Support:

WMU will be administering this project and will conduct the characterization of untreated Kalamazoo River sediments, review of report drafts and preparation of the final report. Equity Resource Environmental, LLC., Surbec-ART Environmental, LLC., and the University of Oklahoma will be providing technical project management support, as well as, river sediment sampling, technical and economic evaluations of the soil washing and stabillization technologies, and technical report preparation. BioChem Environmental Laboratories will provide chemical analytical services.

Equity Resource Environmental, LLC., a Michigan environmental services firm specializes in the assessment, management and remediation of environmental contamination offers expertise and experience in the application of soil washing technologies.

Surbec-ART Environmental (Surbec-ART) is a full service environmental remediation company with extensive experience in development and deployment of in-situ and ex-situ soil and sediment remediation projects. They have completed many treatability studies for soil washing and sediment treatment and have succesfully implemented several large soil remediation projects using soil washing technologies.

Surbec-ART has a close ties to the University of Oklahoma which offers additional technical expertise in the application of soil washing technologies.

BioChem Environmental Laboratories located in Grand Rapids, Michigan is a leading contract laboratory in the State well qualified to carry out the required PCB analytical work.